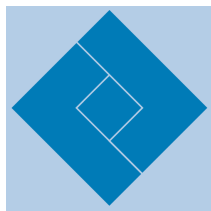


WOUND CARE



Reducing the Risks of Wound Consultation

Adding Digital Images to Verbal Reports

Kathleen M. Buckley ■ Linda Koch Adelson ■ Janice G. Agazio

PURPOSE: The purpose of this study was to examine the impact of digital images on the assessment and recommendations of a WOC nurse who was providing remote nurse-to-nurse consultations on home care patients with wounds.

METHODS: In a descriptive comparative study, data were collected by home care nurses from a sample of 43 adult patients with a total of 89 wounds with various etiologies. To determine whether or not the addition of a digital photograph influenced the WOC nurse's assessment and recommendations, the WOC nurse first completed a wound assessment and recommendation form based on a verbal report from the home care nurse. The WOC nurse then accessed digital images of the wounds and made any indicated modifications to the original assessment and management plan, providing a rationale for any changes. Comparisons were made between the assessment completed by the home care nurse and the WOC nurse's assessment and between the WOC nurse's assessment and recommendations based only on a verbal report and his or her assessment and recommendations based on the combination of a verbal report and a digital photograph.

RESULTS: Although there was a high percentage of agreement between the wound assessments completed by the home care nurse and those completed by the WOC nurse, areas of disagreement often impacted on the overall assessment. The agreement rates between the WOC nurse's assessment and recommendations based only on a verbal report versus those based on a combination of verbal report and digital photographs were as follows: total agreement (26/89 = 29.2%), trivial disagreement (11/89 = 12.4%), and clinically relevant disagreement (52/89 = 58.4%).

CONCLUSIONS: WOC nurses who provide remote nurse-to-nurse consultations without directly visualizing the patients' wounds through digital images are at risk for under- or overtreating patients' wounds. Digital images also provide an opportunity for the WOC nurse to mentor home care nurses in wound assessment and care.

Background

Wound care has become a common part of the home health nursing practice. Caring for patients with wounds accounts for over a third of all cases in home care, and approximately 40% of these patients have multiple wounds.¹ The most common are surgical wounds, pressure ulcers, and vascular leg ulcers.¹ Chronic wound care is costly in the home care setting, and the implementation of the Prospective Payment System in 2000 has forced home health agencies to identify ways to cope with the increasing costs of providing wound care.² It has been estimated that \$2.8 billion is spent each year in the United States for treatment of 3 million to 5 million chronic wounds.³ The presence of chronic wounds also influences quality-of-life issues in terms of time spent on medical care, their effect on comfort and mobility, and their impact on emotional well-being, life satisfaction, and caregiver burden.⁴ Factors that may add to cost of wound care include variability of wound assessment and low use of advanced wound care products.⁵ These factors may lead to prolonged healing times, lower healing rates, increased home health visits, and more frequent hospitalizations secondary to complications.

The primary goals of home care wound management are to provide optimal care and contain costs. When home health nurses have patients with wounds that are not

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healing, they are able to provide a higher level of quality care if the consulting services of a wound care nurse are also available.⁶ In a study of wound care in the home setting, Arnold and Weir⁷ found that 78.5% of the wounds cared for by wound care nurses healed, as opposed to only 36% of those cared for by staff nurses. In a more recent multicenter retrospective chart review study of the impact of wound care nurses upon the outcomes of acute and chronic wounds, Harris and Shannon⁸ reported a decreased number of nursing visits and lower costs for patients with the involvement of registered nurses with enterostomal or advanced wound ostomy skills. WOC nurses are recognized as experts in the management of pressure ulcers and chronic wounds. Furthermore, the list of available wound care products has expanded and become more specialized in the past decade. WOC nurses are often able to recommend the most effective and economic product available and may thus improve healing outcomes by avoiding trial and error.⁶ Unfortunately, in-home consultations by WOC nurses may be costly, unavailable, or impractical due to the time spent in travel and multiple demands for the consultant's time, especially when the patient's home is far from the WOC nurse specialist.^{9,10} Therefore, home care agencies need to find the most effective and economic means of WOC nurse consultation.

Some home care agencies have opted to expand nurse-to-nurse wound consultations via a camcorder or other telehealth systems that allow the home care nurse to videoconference with a wound care nurse via real-time transmission of information.^{5,11-13} Kobza and Scheurich⁵ found this form of telehealth to be associated with improved outcomes, including increased healing rates, shortened healing times, and reductions in the number of home health visits and readmission to hospital for wound complications. However, this type of consultation is viewed by some experts as being costly and "extremely inefficient" since chronic wounds do not generally require immediate intervention.⁴

Store-and-forward technology, which enables the home care nurse to capture wound images through a digital camera or camera phone and transmit them to a wound care nurse via e-mail, a telephone line, a shared server, or an Internet site, is a more efficient and less expensive method of data transmission.^{14,15} Since the wound images are digitized and stored, they do not require the home care nurse and wound care nurse to interact at the same time. In the clinical setting, viewing digital images has been found to be comparable to a standard in-person wound examination and renders similar assessments and treatment plans.¹⁶⁻²⁰ Although less costly than videoconferencing, costs associated with a store-and-forward system include the direct costs of digital imaging equipment, e-mail or Internet access, and the time required to obtain and transmit wound images. In a national survey of 145 home health agencies, Eager²¹ found that 75% used pho-

tographs as part of their wound care documentation. However, it was unclear as to how often these images were used or how they were being used to enhance consultation, assessment, or treatment decisions. Other home care agencies rely on nurse-to-nurse wound consultation based on verbal report from the home care nurse who provides a detailed description of the wound and relevant case information. Verbal reports may be provided during a face-to-face discussion, via a live telephonic conversation, or through e-mail or voice mail.

We reviewed the literature and found no studies focusing on or evaluating the effectiveness of these less costly forms of wound care consultations. The purpose of this study was to compare a WOC nurse's assessment and recommendations based only upon verbal reports from home care nurses with assessments and treatment plans for the same wounds based on verbal report plus digital images of patient's wounds.

■ Methods

This descriptive, comparative study examined the impact of adding digital wound images to standard verbal reports provided by home care nurses on the assessments and recommendations provided by a WOC nurse. Participants comprised a purposive sample of home care adult patients with problematic wounds of various etiologies. *Problematic wounds* were defined as those that did not show improvement within a 2-week period following diagnosis and initial treatment. Initial diagnosis and treatment may not have occurred under the direction of the home health agency.

Study Procedures

Data were collected by 7 home care nurses who were members of a wound, ostomy and continence team. In addition to completing wound care classes presented by a certified WOC nurse, the home care nurses attended and participated in 2-hour monthly wound team meetings. The nurses were equipped with digital cameras and trained to use this technology to attain quality wound images in the home environment. Competency was based on a minimum score of 90% on a proficiency examination completed by each nurse before data collection began.²²

During home care visits, nurses assessed and documented each participant's wound status according to the agency's standardized protocol. The nurses also obtained at least 3 images (close-up, midway, and a distant shot) of each wound using Kodak Easyshare CX7330 digital cameras (Kodak, Rochester, New York) with preset settings for flash and focus and quality images with a 1.1- to 3.1-megapixel resolution. The images included a disposable centimeter-measuring tape inscribed with the date, patient's identification number, and the body part. The original dressing was also included in at least 1 of the photographs to provide a visual assessment of the amount, color, and type of wound drainage or exudate. At the end

of the day, the home health nurses transmitted their images via an encrypted password-protected agency e-mail to the WOC nurse. They also left a verbal report of the wound assessment and patient's condition using a standardized format for wound consultation in the WOC nurse's voice mail.²² The verbal report included (1) wound location, size, and depth; (2) a description of the wound bed and periwound; (3) the amount and type of exudate; and (4) the presence of tunneling and degree of undermining. The patient's diagnosis, comorbidities, medications, nutritional status, tobacco exposure, and use of support surfaces were also provided in the report.

While listening to the verbal report, the WOC nurse completed a wound assessment and care recommendation form for each wound. If there were any gaps in the verbal report, the WOC nurse clarified missing information via follow-up voice mails. After completing the assessment based on verbal report, the WOC nurse then obtained access to the wound digital images and had the opportunity to visually assess the wound and reaffirm or modify the initial management plan, while providing a rationale for any changes. A final consultation report was then prepared by the WOC nurse and sent to the home care nurse for implementation. A copy of the consultation was placed on the patient's chart.

Ethical Considerations

Permission to conduct this study was obtained from the Committee for the Protection of Human Subjects of the Catholic University of America and the Internal Review Board of Adventist HealthCare. During the home visits, the nurses were accompanied by the primary investigator, who obtained written informed consent from the participants to participate in the study in compliance with the Health Insurance Portability and Accountability Act. The images were collected in a manner in which the patients could not be identified and did not include the patients' faces or any other identifying characteristics.

Data Analysis

The unit of analysis was the wound, and multiple wounds of any patient were considered independently. Data obtained through the initial and secondary assessment by the WOC nurse were analyzed using descriptive statistics. Comparisons on wound parameters reported by the home care nurses and observed by the WOC nurse were first examined to determine percent agreement using crosstabs and the κ statistic. Percent agreement was determined by summing the presence and absence of the wound parameter when noted by both the home care nurse and the WOC nurse. For example, for eschar, both the WOC nurse and the home care nurse agreed upon its presence 7.9% of the time and absence 84.3% so that the total percent agreement was calculated at 92.2% for this parameter.

At the completion of data collection, a second independent certified WOC nurse, who was not associated

with the home care agency, reviewed the patient history and digital images for all of the cases. Each case was rated in terms of agreement or disagreement between the pre- and postassessment and recommendations according to the following criteria: (a) total agreement (operationally defined as no disparity in assessment), (b) trivial disagreement (operationally defined as differences in wound assessment but no change in treatment recommendations), and (c) clinically relevant disagreement (operationally defined as differences in wound assessment resulting in changes in treatment recommendations). These criteria were based on modified categories devised by Bowman and colleagues.²³

Qualitative data were generated through the original WOC nurse's written assessment and recommendations. Two doctorally prepared nursing faculty experts in wound care independently analyzed the qualitative data to identify recurrent patterns of change in the WOC nurse's assessments and treatment recommendations before and after viewing the digital images, using content analysis.²⁴

Results

The study population comprised 43 adult patients, who were followed by home care nurses between June 2005 and July 2006. Patients ranged in age from 41 to 95 years (mean age 66.9 years) and resided in the Washington, DC, metropolitan area. Nineteen (44.2%) men and 24 (55.8%) women participated in the study. A total of 89 wounds of a variety of etiologies were assessed and treated (Table 1). More than 80% of the wounds in the study were either pressure ulcers or venous stasis ulcers.

There was a high percentage of agreement on the assessment of wound bed and periwound characteristics between the home care nurses' report and the WOC nurse's assessment based on the digital images for the same wounds (Table 2). Except for dry skin on the periwound, the percent agreement ranged between 82.0% and 100.0%, and the κ statistic for the other characteristics ($P < .01$) validated the high percentage of agreement between the verbal reports by the home care nurses and the digital image assessment by the WOC nurse. However,

TABLE 1.
Frequency and Percentage of Wound Types

Wound types	Frequency	Percentage
Pressure ulcer	46	51.7
Venous stasis ulcer	28	31.5
Surgical	5	5.6
Trauma	5	5.6
Mixed ^a	3	3.4
Other	2	2.2

^aPatients had symptoms of venous disease (leg edema and/or exuding ulcer) and decreased arterial flow with signs of vascular compromise.

TABLE 2.
Percent Agreement and κ Statistic Measuring
Agreement Between Verbal Report and Digital
Assessment

	Agreement (n/N), %	κ (P value)
Wound bed type		
Granulation	87.6 (78/89)	0.667 (<.01)
Epithelial	87.6 (78/89)	0.613 (<.01)
Slough	82 (71/89)	0.605 (<.01)
Eschar	92.2 (82/89)	0.622 (<.01)
Connective	98.8 (88/89)	0.851 (<.01)
Bone	100 (89/89)	^a
Wound characteristic		
Tunneling	100 (89/89)	^a
Undermining	100 (89/89)	^a
Periwound characteristic		
Maceration	88.7 (79/89)	0.683 (<.01)
Erythema	93.2 (83/89)	0.536 (<.01)
Denuded	100 (89/89)	^a
Dry	73 (65/89)	0.37 (.37)
Callous	98.9 (88/89)	0.662 (<.01)
Rash	100 (89/89)	^a

^a κ was not calculated because there was no difference.

there was only 73% agreement ($P = .37$) for dry skin. In 23 of the 89 wounds, the WOC nurse observed dry skin, which was not noted by the home care nurse, although the dry skin often extended well beyond the periwound area, often covering the entire extremity.

Although there was a high percentage of agreement in wound assessment parameters between the home care nurse and the WOC nurse, areas of disagreement frequently had a major impact on the overall assessment and would have resulted in the wounds being under- or overtreated. For example, one participant had leg wounds covered with soft eschar, which the home care nurse had identified and reported as slough. On visualizing the eschar in the digital image, the WOC nurse changed her recommendation from a product used to decontaminate the wound to an enzymatic debrider to remove the eschar.

The WOC nurse frequently added to the assessment provided by the home care nurse after viewing the digital images, noting wound and periwound characteristics not reported by the home care nurse. These characteristics often led to a major change in the treatment recommendations such as interventions to manage problems with the surrounding skin, podiatry issues, recognition of critical colonization or infection, and diagnosis of arterial involvement in wounds initially assessed as venous stasis ulcers or traumatic wounds.

The WOC nurse noted dryness of the surrounding skin in 53.5% of the wounds and recommended the addition of a moisturizer to the skin to maintain skin health,

prevent cracking, and reduce the risk of bacterial colonization (Figure 1).^{25,26} In wounds of the lower extremities and feet, the WOC nurse identified podiatry problems that were not reported by the home care nurse in 30.2% of patients. These problems included changes in skin color, redness, dry skin, and poor foot hygiene (Figure 2). Alterations in the patient's toenail structure, such as thickening, discoloration, splitting, crusting, and separation from the nail bed, led to a referral to podiatry. In 5.7% of the wounds, there was evidence of critical colonization or a bacterial infection as indicated by the presence of extensive erythema, friable wound bed, or hypergranulation tissue that was not reported by the home care nurses. The WOC nurse questioned the diagnosis of venous stasis ulcers in 11.6% of the wounds based on visual indications of arterial involvement, such as a pale wound base, shiny skin, and absence of hair on legs (Figure 3). In these cases, the WOC nurse expressed concern about the continued use of compression until an ankle-brachial index (ABI) or a vascular consult was completed to determine the wound's etiology.

Based on an analysis of the WOC nurse's pre- and post-digital image assessment and recommendations, agreement rates were as follows: total agreement (26/89 = 29.2%), trivial disagreement (11/89 = 12.4%), and clinically relevant disagreement (52/89 = 58.4%). Clinically relevant disagreements tended to result in changes in wound care products. In some cases, the characteristic resulting in a change in treatment, such as maceration or erythema, was identified by the home care nurse, but its scope or severity was not recognized fully until the digital image was viewed by the WOC nurse. In 5 cases, large areas of deep-tissue injury placing the patients at risk for sepsis were identified only after viewing the digital images, leading to substantive changes in topical wound care or referral to a wound care center for surgical debridement.

In 2 cases, not having access to the digital images would have led to inappropriate referrals to specialists. In



FIGURE 1. Dry skin.



FIGURE 2. Long toe nails may cause pressure ulcers.

one instance, the verbal report included a large skin lesion on the patient's buttocks that was attributed to a ringworm rash (tinea corporis). Based on the verbal report, the WOC nurse's initial recommendation was referral to a dermatologist. However, following inspection of the digital images, the WOC nurse suspected that the vesicles and satellite lesions observed in the photograph represented incontinence-associated dermatitis, possibly with a severe



FIGURE 3. Venous stasis ulcer with probable arterial development.

Candida infection. Following this evaluation, treatment was altered to include use of an incontinence cleanser, followed by application of an antifungal ointment and skin protectant. In a second case, the verbal report included a description of a large leg wound (16.5 × 7.6 cm) with "raised grape-like clusters above skin level" in a patient diagnosed with colon cancer. Prior to visualizing the wound, the WOC nurse considered recommending referring the patient for a biopsy of the wound to rule out possible metastasis. After visualizing the digital image, it was clear that the area was a closed wound covered with hypertrophic scar tissue (Figure 4). In these 2 cases, inspection of digital images revealed that a referral was not indicated. In contrast, the additional data provided by the digital photographs resulted in WOC nurse recommendations for referrals to podiatry (20.9%), plastic surgeons (4.7%), vascular surgeons (20.9%), physical therapy (27.9%), and wound clinics.

An unexpected finding emerged when some digital images also allowed visualization of the patient's bed, mattress, wheelchair, shoes, and other pressure redistribution devices. Visual assessment by the WOC nurse resulted in identification of factors that may have inhibited wound healing. As the study progressed, data collectors began to routinely photograph these elements of the patient's home environment. In one situation, the patient was being treated for several skin tears on her left leg. After obtaining a visual image of the patient's electric wheel chair with damage to the leg rest, the source of the wound was identified and recommendations for assisting the patient with wheelchair repairs were undertaken (Figure 5). In other cases, equipment such as a trapeze to prevent shearing was recommended. Additionally, digital photographs allowed identification of misused materials such as powder or gauze between the toes, disposable pads on beds, and extra linen on air-fluidized beds, all of which may contribute to, or exacerbate, new or existing skin conditions.



FIGURE 4. Hypertrophic scar.



FIGURE 5. Electric wheelchair as the source of skin tears on patient's left leg.

■ Discussion

Telephone consultations with physicians are not unusual for home care nurses. Home care nurses also engage in telephonic or person-to-person consultation with WOC nurses to obtain recommendations for treatment. Both types of consultation depend on an accurate description of the wound and identification of environmental and systemic factors affecting wound healing to ensure a successful outcome. The findings of this study suggest that remote consultations with WOC nurses based on verbal report alone may result in inappropriate wound care, while the addition of digital images improves the efficacy of these consultations.

Anecdotally, by the second patient consultation, the WOC nurse recognized the usefulness of the images in providing an objective view of the patient as compared to a report that could be interpreted subjectively. The WOC nurse stated that it was not only the close-up shots of the wound but also the distant shots including both extremities that were providing information that would have been missed. For example, in 2 cases, the WOC nurse was able to identify fungal infections and, in another case, signs of eczema located outside the periwound area that had not been reported by the home care nurse. When photographing lower-extremity wounds, we found that having images of both extremities provided a comparison that helped assess the severity of the condition. By the 20th

patient, the WOC nurse refused to provide consults without images because of ethical concerns associated with pursuing wound care without this important data source. Some of the home care nurses also reported that they found the images useful in documenting their assessment and care. As one home care nurse stated, "When I was giving my referral, all I had to do was flip back to the pictures to describe them as best I could." The WOC nurse also used the images to mentor the wound care team nurses at their monthly meetings.

The addition of digital images also enabled the WOC nurse to use more than one sense when remotely assessing a wound. While communication through voice mail may enhance the speed of consultation, there are inherent difficulties.²⁷ The speaker's tone of voice, speaking volume, and speed and choice of words influence the clarity of the assessment. For example, substituting the term *soft eschar* for *slough* may change the treatment plan. A digital image overcomes these potential limitations by providing an objective record of each wound and surrounding tissue.²⁸

The WOC nurse found that digital images unexpectedly revealed data about the patients' environment, resulting in a more comprehensive assessment than those attained using verbal reports alone. Paralleling Benner's²⁹ model of novice-to-expert development, some of the home care nurses provided assessments of the wound bed and periwound skin, but missed factors outside this area that influenced wound healing and optimal management. With the addition of digital image, the WOC nurse used her expertise to incorporate assessment parameters outside immediate wound area and to provide the appropriate level of assistance needed for an effective consultation. For example, the WOC nurse was consulted when a nurse colleague experienced difficulty obtaining a physician order for a wound culture on a patient with venous stasis ulcers. The ulcers lacked obvious signs of infection, such as fever or periwound erythema, but digital imaging revealed a friable wound bed with a large amount of bloody drainage, hypergranulation, a foul odor, and small circular wounds on the periwound skin. Following consultation with the WOC nurse, the home care nurse was able to obtain the validation needed to persist in her efforts to convince the primary care provider of the need for the culture. A culture was ultimately obtained that grew β -hemolytic streptococcus and pseudomonas, requiring treatment with systemic antibiotics.

Although the gold standard of wound assessment remains the bedside examination,³⁰ Debray and associates¹⁶ found that digital images of wounds may provide more visual information than do conventional inspection. The ability to magnify the image using computer software allows for identification of subtle differences that may have been missed on direct visual inspection. In contrast, the inability to palpate the wound or to detect odors is a potential limiting factor that should be addressed in the

verbal report. Our data suggest that use of digital images provides a cost-effective and efficient way to enhance WOC nurse consultation. Digital images also enhance the effectiveness of ongoing consultation by enabling assessment of visual changes over time necessary for monitoring progress toward wound healing.⁴

Limitations and Recommendations

A major limitation of the study was the use of only 1 WOC nurse, whose judgments formed the basis for all of the wound assessments and recommendations. To improve validity in the findings, a second certified WOC nurse was used to rate the level of agreement or disagreement between the assessment and recommendations made before and after viewing the digital images.

The investigators were also concerned about the photography skills of the nurses who were taking the images. Accurate use of a digital camera is an acquired skill that is not difficult, but taking high-quality wound images consistently requires practice. There can be a steep learning curve for obtaining accurate, useful high-quality digital images with attention to issues of image security, confidentiality, and infection control.³¹ In order to control for this, the home care nurses were provided training and competency testing in the use of the cameras, and the same type of camera was used for all images. Since the WOC nurse's analysis was dependent on the quality of the images, it would be expected that the ability to make an accurate assessment would have also improved over time with access to better-quality images. In addition, the small sample size of 43 patients and the diversity of the wounds and varying patient comorbidities limit the ability to generalize the results to different populations and to provide sufficient data for clear, conclusive study outcomes.

Summary

Based on this study's findings, WOC nurses should carefully consider the limitations of providing informal or formal wound ostomy consultations with other nurses without direct contact with the patient at the bedside or indirect access via digital or video images. Although it may be convenient to offer expert advice by telephone or in an agency hallway when approached by another nurse, there are health risks to the patient and legal risks to nurse consultants with this practice. An incomplete or inaccurate description from the nurse, who is seeking the consultation, may lead to inadequate or inappropriate assessments, recommendations, and referrals by the nurse consultant. Digital images not only improve direct assessment of the wound but also are helpful in identifying periwound and environmental factors that may facilitate the healing process. Overall, digital images enhance the WOC nurse's ability to provide consultations that are safe and accurate.

KEY POINTS

- ✓ Digital images extended the WOC nurse's view of the patients and their environment and provided a more holistic assessment of the patient beyond the limits of the wound bed and adjacent periwound skin provided by verbal reports.
- ✓ WOC nurses who provide remote nurse-to-nurse consultations without directly visualizing the patients' wounds through digital images are at risk for under- or overtreating patients' wounds and may be putting themselves at risk for legal liability.

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